RESEARCH ARTICLE

Determinants of Participation in a Breast Cancer Screening Trial in Trivandrum District, India

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Abstract

Background: Conspicuous differences in participation rates for breast self-examination (BSE), clinical breast examination (CBE), and referral for further investigations have been observed indicating involvement of a number of different factors. This study analysed determinants for participation in different levels of the breast cancer screening process in Indian females. Materials and Methods: An intervention group of 52,011 women was interviewed in a breast cancer screening trial in Trivandrum district, India. In order to assess demographic, socio-economic, reproductive, and cancer-related determinants of participation in BSE, CBE, and referral, uni- and multi-variate logistic regression was employed. Results: Of the interviewed women, 23.2% reported practicing BSE, 96.8% had attended CBE, and 49.1% of 2,880 screen-positives attended referral. Results showed an influence of various determinants on participation; women who were currently not married or who had no family history of cancer were significantly less likely to attend the screening process at any level. Conclusions: Increasing awareness about breast cancer, early detection methods, and the advantages of early diagnoses among women, and their families, as well as health care workers offering social support, could help to increase participation over the entire screening process in India.

Keywords: breast cancer screening - low and middle income countries - clinical breast-examination - India

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Introduction

According to estimates in GLOBOCAN for 2008 (Ferlay et al., 2010), worldwide breast cancer is the most common cancer with 1,383,500 cases, and the most frequent cause of cancer death in women, accounting for 458,400 deaths annually; in India it is the second most common cancer in women in terms of incidence and mortality, with 115,251 new cases and 53,592 deaths annually. Limited access to early detection and treatment is responsible for more than half of the breast cancer deaths, mainly in low- and middle-income countries (LMIC), where no organized mammography screening is affordable or feasible (Sankaranarayanan et al., 2011b). In order to cope with the increasing incidence of and mortality from breast cancer in these countries, the effectiveness of clinical breast examination (CBE), as an alternative screening option, is presently being investigated in two different trials in India (Dinshaw et al., 2007a; 2007b; Sankaranarayanan et al., 2011a). These two randomized controlled trials are being conducted to evaluate the effectiveness of CBE in lowering breast cancer mortality of women. In both trials, women were educated about breast cancer, including breast self-examination (BSE) as a method of early detection. BSE alone did not show a decrease in mortality or down-staging of advanced cancer in earlier clinical trials, but is expected to increase breast cancer awareness and might help to decrease tumour size and stage at diagnosis in settings where women mainly present with late stages (Garg et al., 2010; Mittra, 2011; Corbex et al., 2012; Panieri, 2012).

It is too early yet to draw conclusions about the effectiveness of CBE in reducing breast cancer mortality in LMIC. However, firm conclusions require high participation rates during the entire programme at the different levels and compliance with screening advice and call up for diagnostic procedures among screen-positive women. In the CBE trial in Trivandrum district, high participation rates (97% for both interview and CBE) were reported in the intervention group in the first round, but only 23% of the women reported practicing BSE, even occasionally, and 49% of the CBE screen-positive women attended a breast clinic for diagnostic check-up. Differences in participation rates at different levels of the on-going trial for breast and cervix cancer screening in Mumbai, India have also been reported (Dinshaw et al., 2007a; 2007b; Mittra et al., 2010) and an initial CBE trial in Manila, Philippines (Pisani et al., 2006) with a

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participation rate of 81% was discontinued after only 37% of screen-positive women reported for diagnostic investigations.

Different factors may be responsible for the conspicuous differences in participation rates at different levels of the breast screening process. In this study we analysed and compared determinants of participation for BSE, CBE, and breast clinic attendance in the first of three rounds of the breast cancer screening trial in Trivandrum, India. Our results will be used to make recommendations for the on-going breast cancer early detection trials and for breast screening programmes in comparable settings to increase participation rates.

Materials and Methods

Study setting

The Trivandrum breast cancer screening cluster randomized controlled trial was implemented in January 2006 to evaluate the effectiveness of CBE in reducing breast cancer mortality compared with no screening. Eligible subjects in the trial setting were healthy women, aged 30-69 years with intact breasts and no history of breast cancer.

Two groups of clusters were randomly assigned: 133 clusters (55,844 women) to the intervention group and 142 clusters (59,808 women) to the control group. Women in the control group received education on cervical cancer prevention and advice on how to access cervical cancer screening and treatment. Women in the intervention group received person-to-person and group health education aiming to increase their awareness of breast cancer as a personal risk, to recognise the symptoms and signs (breast mass) and how to detect it early, to propagate knowledge that, when treated in its early stages, breast cancer has an excellent prognosis, and where affordable and ready access to an effective diagnostic and treatment service is provided. Group health education was completed within the first 12 months of the study period. The health workers visited the homes of the eligible women and offered them one-on-one health education, obtained informed consent, interviewed the women and offered CBE. All suspicious clinical findings, including lumps, ulceration, nipple discharge, or retraction were systematically recorded on a form. Women with suspicious clinical findings were reported as "screen-positive" and given an appointment to attend the next breast clinic, organized every second Saturday at the clusters' project office. Women who did not report to the breast clinic were contacted by phone and given a second appointment. At the breast clinics a doctor conducted a thorough CBE and women requiring further investigations were invited to visit the Regional Cancer Centre in Trivandrum for diagnostic investigations (mammography, ultrasonography, fine needle aspiration cytology, and, if needed, biopsy) and those with confirmed breast cancer were referred for adequate treatment. The women of the intervention and control groups were followed-up for incident breast cancers by linkage with the Trivandrum district population-based cancer registry. For a detailed description of the study see Sankaranarayanan et al. (2011a).

Study design

Data collected from women in the intervention group in the first round of the above-mentioned breast cancer screening randomized trial in Trivandrum were used in this analysis. Women were interviewed using a structured questionnaire at their homes by a health worker, before the CBE was offered. Information such as household monthly income and type of house was collected, as well as individual information about the women's level of education, her occupation (housewife, unemployed, manual, technical, office going/teaching, professional, business), demographic (age, religion, marital status), reproductive (method of contraception ever used, hormone pills ever taken, number of pregnancies), and cancer-related characteristics (family/own history of cancer, and practicing BSE). Health care workers offered to provide a CBE, and if accepted, noted the result, symptoms (lumps, ulceration, nipple discharge, retraction, or others) and referred CBE-positive women to the breast clinic. Women who were referred were followed-up and attendance at the breast clinic was recorded.

Statistical analysis

Demographic, socio-economic, reproductive, and cancer-related determinants of 1) practicing BSE, 2) accepting CBE during interview, and 3) attending breast clinic if screened positive at the CBE were assessed in uni- and multi-variate logistic regressions analyses, estimating odds ratios (OR) and their 95% confidence intervals (95%CI). All analyses were adjusted for cluster design. The multiple logistic regression analyses were adjusted for all socio-economic, demographic, reproductive, and cancer-related characteristics that were included in the uni-variate analyses. Dose response trends were tested for age, education and income, by including the categorical variables as continuous variables in the multi-variate analyses. Data analyses were carried out using STATA statistical software version 11.

Results

In the first round 55 844 women were enrolled in the intervention group and 97% (52 011) participated in the interview. Among those 12 081 (23.2%) reported practicing BSE "sometimes" or "regularly" and 50 366 (96.8%) accepted a CBE by the health worker during interview. Of those, 2880 (5.7%) were screened positive and referred to a breast clinic, of which 1415 (49.1%) attended.

Table 1 shows the distribution of women's characteristics for practicing BSE, and the unadjusted and adjusted ORs. In the adjusted results, being not married (single/separated/widowed) and aged above 60 years were significant demographic characteristics that decreased the likelihood to practice BSE occasionally or regularly. Education, occupation, and type of house were independently associated with practicing BSE and showed that women with high social status were more likely to practice BSE. Highest ORs were found for education: the higher the level of education, the more likely women were to practice BSE (ORs increase from 1.76 to 7.86, p

Table 1. Distribution, Unadjusted and Adjusted Odds Ratios for Performing Breast Self-examination

		Total N	Performing BSE N (%)		crude OR (95%CI)		adjusted OR (95%CI)		p trend
Demographic characteristics									
Age	30-39	18,053	5,227	(29.0)	1.00		1.00		0.004
	40-49	14,502	3,761	(25.9)	0.86	(0.79-0.93)	1.13	(1.03-1.24)	
	50-59	10,882	2,200	(20.2)	0.62	(0.54-0.72)	0.97	(0.83-1.14)	
	60-69	8,574	893	(10.4)	0.29	(0.22-0.37)	0.66	(0.51-0.85)	
Religion	Hindu	37,307	8,765	(23.5)	1.00		1.00		
	Muslim	9,451	2,102	(22.2)	0.93	(0.66-1.32)	0.93	(0.67-1.29)	
	Christian	5,253	1,214	(23.1)	0.98	(0.51-1.87)	1.11	(0.65-1.88)	
Marital Status	Married	40,694	10,601	(26.1)	1.00		1.00		
	Unmarried	11,317	1,480	(13.1)	0.43	(0.38-0.48)	0.83	(0.76-0.91)	
Socioeconomic characteristics									
Education	Nil	5,944	305	(5.1)	1.00		1.00		<0.001
	Primary	7,384	713	(9.7)	1.98	(1.63-2.39)	1.76	(1.47-2.10)	
	Middle	9,479	1,422	(15.0)	3.26	(2.67-3.99)	2.62	(2.17-3.17)	
	High school	19,467	5,274	(27.1)	6.87	(5.13-9.19)	4.62	(3.53-6.06)	
	College & above	9,737	4,367	(44.8)	15.04	(10.27-22.01)	7.86	(5.47-11.30)	
Occupation	House wife	46,059	10,388	(22.6)	1.00		1.00		
	Manual	3,631	391	(10.8)	0.41	(0.30-0.57)	0.65	(0.48-0.87)	
	Others	2,321	1,302	(56.1)	4.39	(3.57-5.39)	2.20	(1.83-2.65)	
Income	< 2000	29,070	5,281	(18.2)	1.00		1.00		0.195
	2000-5000	16,045	4,015	(25.0)	1.50	(1.15-1.96)	0.98	(0.72-1.33)	
	>5000	6,896	2,785	(40.4)	3.05	(2.28-4.08)	1.39	(0.94-2.06)	
Housing	Thatched	8,560	1,306	(15.3)	1.00		1.00		
	Tiled	18,972	3,394	(17.9)	1.21	(0.99-1.48)	0.99	(0.84-1.17)	
	Concrete	24,479	7,381	(30.2)	2.40	(1.95-2.96)	1.25	(1.07-1.45)	
Reproductive characteristics									
Method of Contraception	None	17,264	3,625	(21.0)	1.00		1.00		
	Some	34,630	8,442	(24.4)	1.21	(1.05-1.40)	1.19	(1.03-1.37)	
Hormonpills	No	50,354	11,441	(22.7)	1.00		1.00		
	Yes	1,599	612	(38.3)	2.11	(1.67-2.66)	1.59	(1.27-1.99)	
Pregnancies	0	2,086	378	(18.1)	1.00		1.00		
	1-2	23,337	6,448	(27.6)	1.73	(1.48-2.01)	1.14	(0.98-1.32)	
	3+	26,588	5,255	(19.8)	1.11	(0.97-1.27)	1.02	(0.87-1.20)	
Cancer related characteristics									
Personal History of Cancer	No	51,748	12,004	(23.2)	1.00		1.00		
	Yes	263	77	(29.3)	1.37	(0.97-1.93)	1.98	(1.38-2.84)	
Family History of Cancer	No	46,874	10,592	(22.6)	1.00		1.00		
	Yes	5,137	1,489	(29.0)	1.40	(1.23-1.59)	1.24	(1.10-1.39)	

for trend <0.001); compared to housewives, women with manual occupations who were 35% less likely to practice BSE; women with professional occupations (other than manual) were 2.20 times more likely to practice BSE. Use of contraception methods or hormone pills, personal history of cancer, and family history of cancer also independently increased BSE practice by 19%, 59%, 98%, and 24%, respectively.

Distribution of characteristics and related ORs for compliance with CBE during interview are presented in Table 2. Adjusted results showed that women ≥ 40 years were about 15% less likely to attend CBE than the 30 - 39 year-olds. Women of Muslim religion, college education and above, professional occupations (other than manual), whose monthly household income was more than 5000 Indian rupees, who had a personal history of cancer and practicing BSE were about 40% less likely to take part in CBE than the respective reference groups. Unmarried women were 28% less likely to attend CBE than married women, while women who had three or more pregnancies, had ever used any contraceptive method, or had a family history of cancer, were more likely to comply for CBE.

Results for 'attending breast clinics' for the 2880 screen-positive women are shown in Table 3. Adjusted results showed that Christians were about 40% less likely to attend breast clinics than Hindus. Furthermore, currently both not married women and those with manual occupations were about 20% less likely to attend breast clinics than married women and housewives. Women with a family history of cancer were 1.35 times more likely to attend referral than those with no family history of cancer.

Discussion

In the breast cancer screening Trial in Trivandrum, women who were not married (single/separated/widowed) were significantly less likely to participate in any level of the screening process than married women; they were about 20% less likely to practice BSE, to take part in CBE, and to attend a breast clinic if screened positive. Being currently not married was also reported as a factor for non-compliance in breast and cervical cancer screening programmes (Dinshaw et al., 2007a; 2007b; Nene et al., 2007; Taha et al., 2010; Dahlui et al., 2012), for increased distress among cancer patients (Pandey et al., 2006), and for late stage presentation of breast cancer in a hospital in south India (Ali et al., 2008). That women without a husband are less likely to take part in cancer screening programmes might be due to a lack of social support (emotional, informational, tangible, and

Table 2. Distribution, Unadjusted and Adjusted Odds Ratios for Participating in Clinical Breast Examination

		Total N	Participating CBE N (%)		crude OR (95%CI)		adjusted OR (95%CI)		p trend
Demographic characteristics									
Age	30-39	18,053	17,484	(96.8)	1.00		1.00		0.034
	40-49	14,502	14,038	(96.8)	0.98	(0.90-1.08)	0.84	(0.75-0.94)	
	50-59	10,882	10,523	(96.7)	0.95	(0.84-1.08)	0.81	(0.70-0.94)	
	60-69	8,574	8,321	(97.0)	1.07	(0.91-1.26)	0.87	(0.72-1.06)	
Religion	Hindu	37,307	36,232	(97.1)	1.00		1.00		
	Muslim	9,451	9,034	(95.6)	0.64	(0.50-0.82)	0.61	(0.49-0.76)	
	Christian	5,253	5,100	(97.1)	0.99	(0.58-1.68)	0.95	(0.64-1.42)	
Marital Status	Married	40,694	39,471	(97.0)	1.00		1.00		
	Unmarried	11,317	10,895	(96.3)	0.80	(0.69-0.93)	0.72	(0.64-0.82)	
Socioeconomic characteristics									
Education	Nil	5,944	5,798	(97.5)	1.00		1.00		0.003
	Primary	7,384	7,213	(97.7)	1.06	(0.84-1.35)	0.97	(0.76-1.23)	
	Middle	9,479	9,270	(97.8)	1.12	(0.85-1.47)	1.02	(0.78-1.33)	
	High school	19,467	18,857	(96.9)	0.78	(0.61-1.00)	0.80	(0.62-1.03)	
	College & above	9,737	9,228	(94.8)	0.46	(0.32-0.64)	0.63	(0.45-0.88)	
Occupation	House wife	46,059	44,676	(97.0)	1.00		1.00		
	Manual	3,631	3,565	(98.2)	1.67	(1.16-2.40)	1.25	(0.88-1.77)	
	Others	2,321	2,125	(91.6)	0.34	(0.27-0.41)	0.60	(0.51-0.70)	
Income	< 2000	29,070	28,369	(97.6)	1.00		1.00		0.002
	2000-5000	16,045	15,509	(96.7)	0.71	(0.58-0.89)	0.89	(0.73-1.08)	
	>5000	6,896	6,488	(94.1)	0.39	(0.30-0.52)	0.66	(0.51-0.84)	
Housing	Thatched	8,560	8,371	(97.8)	1.00		1.00		
	Tiled	18,972	18,517	(97.6)	0.92	(0.76-1.12)	1.01	(0.83-1.23)	
	Concrete	24,479	23,478	(95.9)	0.53	(0.43-0.65)	0.83	(0.65-1.05)	
Reproductive characteristics									
Method of Contraception	None	17,264	16,541	(95.8)	1.00		1.00		
	Some	34,630	33,718	(97.4)	1.62	(1.40-1.86)	1.24	(1.07-1.43)	
Hormonpills	No	50,354	48,787	(96.9)	1.00		1.00		
	Yes	1,599	1,531	(95.7)	1.38	(1.02-1.87)	0.91	(0.68-1.22)	
Pregnancies	0	2,086	1,922	(92.1)	1.00		1.00		
	1-2	23,337	22,567	(96.7)	2.50	(2.01-3.12)	2.38	(1.92-2.95)	
	3+	26,588	25,877	(97.3)	3.11	(2.49-3.88)	2.79	(2.24-3.48)	
Cancer related characteristics									
Personal History of Cancer	No	51,748	50,117	(96.8)	1.00		1.00		
	Yes	263	249	(94.7)	0.58	(0.32-1.03)	0.57	(0.32-0.99)	
Family History of Cancer	No	46,874	45,362	(96.8)			1.00		
	Yes	5,137	5,004	(97.4)	1.25	(1.06-1.49)	1.42	(1.20-1.69)	
Breast-Self-Examination	No	39,930	38,902	(97.4)	1.00		1.00		
	Yes	12,081	11,464	(94.9)	0.49	(0.39-0.62)	0.61	(0.50-0.75)	

companionship support) that can negatively affect breast and cervical cancer screening practices (Gamarra et al., 2009; Silva et al., 2009). Health workers should be trained to address risk factors of breast cancer among unmarried women that apply particularly to them (e.g. nulliparity) to create awareness and involving family or friends in the counselling process might help to increase social support and participation in screening among all women currently without a husband.

In our study, women aged ≥ 60 years were significantly less likely to practice BSE than women < 40 years, and women between 40 and 60 years were less likely to attend CBE than women < 40 years, while no significant influence of age for breast clinic attendance was found. Other studies in India have shown that aging negatively affects participation in breast and cervical cancer screening, referral and treatment (Sankaranarayanan et al., 2003; Dinshaw et al., 2007b; Nene et al., 2007), and was related to delayed presentation of breast cancer (Ali et al., 2008). It is possible that with increasing age it is more difficult to change behaviour and, therefore, older women are less likely to participate in early detection methods when they feel healthy as well as the fact that screening used to be very uncommon in most LMIC.

Most women in this study were Hindus, with a minority of Muslims and Christians. Results showed that, compared to Hindus, Muslims were less likely to comply for CBE, while Christians were less likely to attend the breast clinic. In the Mumbai trial, Muslims were also less likely to attend screening than Hindus, while a population-based survival study from cancers of the breast, cervix and ovary showed that, for all cancer sites, Muslims had a higher and Christians a lower 5-year survival compared to Hindus (Yeole et al., 2004). This reveals that religion is an important determinant for participation in cancer early detection methods in India and it should be investigated in further studies whether this is related to religious beliefs and behaviours or is correlated to the social position that different religious groups hold in the society.

Overall, trends showed that the better off were more likely to practice BSE, but were less likely to participate in the offered CBE. These results are partly in line with other studies that reveal a higher rate among socially advantaged groups for practicing BSE. Education has especially been reported to be positively associated with BSE in different settings (Yavari and Pourhoseingholi, 2007; Gupta 2009; Sim et al., 2009; Khokher et al., 2011) and it was also the most powerful independent determinant

Table 3. Distribution, Unadjusted and Adjusted Odds Ratios for Attending the Breast Clinic among Positive-Screened Women

		Total N	Attending Breast Clinic N (%)		crude OR (95%CI)		adjusted OR (95%CI)		p trend
Demographic characteristics									
Age	30-39	1,172	586	(50.0)	1.00		1.00		0.890
	40-49	958	485	(50.6)	1.03	(0.86-1.22)	1.10	(0.92-1.31)	
	50-59	493	234	(47.5)	0.90	(0.73-1.11)	1.03	(0.79-1.33)	
	60-69	257	110	(42.8)	0.75	(0.53-1.06)	0.95	(0.65-1.38)	
Religion	Hindu	2,071	1,024	(49.4)	1.00		1.00		
	Muslim	501	278	(55.5)	1.27	(1.01-1.61)	1.17	(0.89-1.53)	
	Christian	308	113	(36.7)	0.59	(0.41-0.85)	0.60	(0.42-0.86)	
Marital Status	Married	2,397	1,214	(50.6)	1.00		1.00		
	Unmarried	483	201	(41.6)	0.69	(0.61-0.80)	0.81	(0.70-0.94)	
Socioeconomic characteristics									
Education	Nil	243	102	(42.0)	1.00		1.00		0.018
	Primary	359	148	(41.2)	0.97	(0.70-1.35)	0.91	(0.64-1.28)	
	Middle	523	226	(43.2)	1.05	(0.74-1.49)	0.90	(0.64-1.25)	
	High school	1,166	612	(52.5)	1.53	(1.10-2.11)	1.21	(0.88-1.66)	
	College & above	589	327	(55.5)	1.73	(1.22-2.45)	1.25	(0.87-1.78)	
Occupation	House wife	2,511	1,250	(49.8)	1.00		1.00		
	Manual	251	99	(39.4)	0.66	(0.52-0.84)	0.78	(0.61-1.00)	
	Others	118	66	(55.9)	1.28	(0.98-1.67)	1.05	(0.74-1.49)	
Income	<2000	1,542	700	(45.4)	1.00		1.00		0.093
	2000-5000	897	456	(50.8)	1.24	(1.06-1.46)	1.08	(0.88-1.32)	
	>5000	441	259	(58.7)	1.71	(1.28-2.29)	1.33	(0.96-1.84)	
Housing	Thatched	439	193	(44.0)	1.00		1.00		
	Tiled	1,044	481	(46.1)	1.09	(0.91-1.30)	1.00	(0.83-1.21)	
	Concrete	1,397	741	(53.0)	1.44	(1.17-1.78)	1.05	(0.82-1.35)	
Reproductive characteristics									
Method of Contraception	None	807	379	(47.0)	1.00		1.00		
	Some	2,067	1,033	(50.0)	1.13	(0.95-1.35)	1.10	(0.93-1.31)	
Hormonpills	No	2,726	1,326	(48.6)	1.00		1.00		
	Yes	151	87	(57.6)	1.44	(1.05-1.95)	1.26	(0.91-1.75)	
Pregnancies	0	131	56	(42.7)	1.00		1.00		
	1-2	1,376	679	(49.3)	1.30	(0.93-1.83)	1.11	(0.77-1.60)	
	3+	1,373	680	(49.5)	1.31	(0.93-1.86)	1.20	(0.82-1.77)	
Cancer related characteristics									
History of Cancer	No	2,865	1,411	(49.2)	1.00		1.00		
	Yes	15	4	(26.7)	0.37	(0.09-1.54)	0.35	(0.09-1.44)	
Family History of Cancer	No	2,498	1,199	(48.0)	1.00		1.00		
	Yes	382	216	(56.5)	1.41	(1.12-1.77)	1.35	(1.09-1.68)	
Breast-Self-Examination	No	1,912	911	(47.6)	1.00		1.00		
	Yes	968	504	(52.1)	1.19	(0.98-1.45)	1.01	(0.84-1.20)	
Symptom Lump	No	1,113	543	(48.8)	1.00		1.00		
	Yes	1,767	872	(49.3)	1.02	(0.82-1.28)	1.04	(0.84-1.30)	

in this study. Higher education might increase knowledge about breast cancer and BSE (Kumar et al., 2011), and knowledge was reported to be a strong predictor for BSE (Gupta 2009; Al-Naggar et al., 2011; Rasu et al., 2011). Therefore, education programmes, aiming to increase breast awareness and the practice of BSE, should target less educated women to increase their knowledge about breast cancer early detection methods.

Despite higher participation rates for BSE, women with high social status in this study were less likely to attend CBE. This was also shown for participation in CBE and cervical cancer screening in the Mumbai (Dinshaw et al., 2007b) and Philippines trials (Pisani et al., 2006), and for participation in a cervical cancer screening trial in south India (Sankaranarayanan et al., 2003). One likely explanation is that these women can afford private health care where they expect more professional care than in the trials setting. However, it is also possible that they refuse CBE for other reasons, e.g. using other prevention methods such as BSE or mammography. For example, in our study, women who practiced BSE were also less likely to attend CBE and in a study in Malaysia with different ethnic groups (Dunn et al., 2010), performance of BSE lowered the probability of mammography screening among Indian women. It is, therefore, important to analyse whether Indian women used BSE as a substitute for CBE. Adjusted results showed no influence of socio-economic characteristics on breast clinic attendance, but significant trends for education suggest a positive association between breast clinic attendance and education. Also no influence of income or other socio-economic characteristics on referral were found in the Mumbai trial (Dinshaw et al., 2007a), while a study in a hospital in south India showed that women from poorer households were more likely to present at late-stage (Ali et al., 2008). Results from a study that investigated determinants of non-participation in a cervical cancer screening programme in India highlighted the role of indirect costs as women from economically disadvantaged households could not attend the screening programme even if they wanted to, due to family obligations or to work where absence would mean loss of daily wage earnings (Basu et al., 2006). High indirect costs were also supposed to increase loss to follow-up among patients from lower economic groups, due to

increased distress, in a study that was conducted among cancer patients at the Regional Cancer Centre Trivandrum (Pandey et al., 2006).

In this study, women who used contraception methods had increased participation both in BSE and CBE. Those taking hormone pills had increased participation in BSE, and those who had one or more pregnancies had increased participation in CBE. Reproductive factors were also reported as positive predictors for cervical cancer screening attendance, which might be explained by increased awareness about gynaecological procedures and female disorders, that encourages further contacts with health care services (Sankaranarayanan et al., 2003; Nene et al., 2007).

In our study, women with a family history of any cancer were significantly more likely to participate in every level of the screening process. This could be due to a higher awareness among them and to the social support they might receive from family members who are also more aware about cancer or who have undergone similar experiences. Family history as a determinant for practicing BSE and for compliance to breast cancer screening was reported in other studies with controversial results (e.g. over- and under-use) (Cohen, 2006; Dinshaw et al., 2007b; Al-Naggar et al., 2011), which might be due to differences in outcome measures or populations or to possible controversial effects, e.g. it might increase participation among some women, while keeping others away because of increased anxiety and distress. Our results have shown that the kind of symptoms (lumps, ulceration, nipple discharge, retraction, other) found by the health workers during CBE did not have any influence on women's decision to attend the breast clinic.

Our results showed that several demographic, socio-economic, reproductive and cancer-related characteristics influence participation in different levels of a screening programme and that these characteristics can vary on each level. A limitation of this study was that only health care utilization within the study programme had been documented. Therefore, no information was available regarding whether women who had not participated in CBE or who had not attended the breast clinic used any other health services. As it is expected that women with higher socio-economic status are more likely to visit health care facilities other than those provided in this trial, our results are likely to underestimate socio-economic differences for referral and to overestimate differences for CBE. However, the number of women who used other health services is expected to be very low in this setting. Practicing BSE was self-reported and results might, therefore, be biased by socially desirable answers.

This study is the first that shows the influence of different determinants on BSE, CBE, and referral in a breast cancer screening trial in a low- and middle-income country, using high quality data from more than 50,000 women. The results indicate that education programmes, with the aim to increase knowledge about breast cancer and breast awareness and to increase participation in early detection methods and referral, should focus on the needs of single, divorced and separated women, of women from socially disadvantaged groups (i.e., with none, primary or secondary education and with manual occupations), with no experience regarding gynaecological procedures, or no family history of cancer (Gupta, 2009; Kumar et al., 2011).

Focus should be on referral among screen-positive women, especially because failure to report to healthcare facilities after detecting a breast lump has been described as a major reason for delayed breast cancer diagnosis in LMIC (Garg et al., 2010; Anyanwu et al., 2011). Breast cancer awareness campaigns must impart the important message that it is the delay rather than the diagnosis itself that should be feared. Being screened positively during a CBE causes distress and possibly has a negative influence on breast clinic attendance (Meechan et al., 2005; Woodward and Webb, 2001). Therefore, health care workers in any screening programme should be specifically trained in how to communicate positively to women, to be able to motivate them to attend the breast clinic and to keep women's stress as low as possible, e.g. supportive care that incorporates informational and emotional support and follow-up telephone consultations which were shown to decrease anxiety levels of women with suspected breast cancer (Liao et al., 2010). More effort in this direction might help to increase attendance rates among women without a husband and with manual occupations (i.e., possibility to bring family members or children to the breast clinic, offering transport, informing and encouraging family members or employers to support participation in screening). Overall, enhancing the empowerment of women and strengthening their status might enable them to access and use external resources successfully and increase participation in referral (Luszczynska et al., 2012). In future research, it would be helpful to collect additional information on women's knowledge and awareness about breast cancer, their attitudes towards early detection methods and on their health seeking behaviour in a setting of a randomized controlled screening trial to better understand reasons for participation/non-participation and to be able to evaluate non-clinical outcomes from the perspective of the participating women.

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